MEASURING EFFECTIVENESS OF INDUSTRIAL WASTE REDUCTION ASSESSMENTS

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Background - Waste reduction saves companies money. This should not surprise us because it is only process improvement by another name. TVA has long believed that many industries wanted to reduce waste but did not have the knowledge to do so without risk. In partnership with TVA, the Tennessee Department of Health & Environment (now Environment & Conservation) submitted an application for the first round of PPIS grants to US EPA. This application proposed testing the idea of using retired engineers and scientists to deliver low-cost waste reduction assistance to industries in Tennessee.

When Tennessee received the grant, they partnered with the University of Tennessee's Center for Industrial Services (CIS) to manage the program. Beginning in 1989, this program recruited retired engineers and scientists, trained them in waste reduction, and dispatched them to industries which had requested assessments. The service is free and confidential and implementation of any recommendations is voluntary. As a partner in this demonstration, TVA provided funds for some assessments and in-kind support, including technical expertise.

This demonstration assessed 32 industries and identified opportunities to annually reduce 950 tons of hazardous waste, 600 tons of non-hazardous solid waste, and 680 thousand gallons of wastewater. This success led to the continuation of the program in Tennessee and adoption by eleven other states and the City of Los Angeles, each with their own unique priorities and style.

Measurement Studies - To determine whether identifying opportunities actually resulted in implementation of waste reduction TVA funded two independent studies, first in Tennessee then in Alabama. Letters with questionnaires were sent to the companies with phone follow-up to ensure completeness. The industries were asked to provide data on actual waste reduced and dollars saved. In Tennessee the follow-up was approximately four years after the initial assessment was done and the report provided

to the company. Five of the thirty-two companies declined to participate. The total annual savings were over $2,380,000, an average of over $88,000 per year per company. If you allocated these savings to the retirees and to the other participants (i.e. UT-CIS, TVA, and TDEC), the savings attributable to retirees were over $66,000 per year per company. The average cost for retiree assessments was $1,844 per company which results in a benefit:cost ratio of 36:1.

The Alabama Waste Reduction Assessment & Technology Transfer (WRATT) program began in 1990. It is a non-profit, 501.c.3 foundation and the only waste reduction assistance program run entirely by retirees. In 1995 TVA and WRATT decided to do follow-up. The first 35 respondents saved over $3,480,000 per year; reduced solid waste over 36,000 tons per year; reduced hazardous waste over 75 tons per year; and reduced water usage over 103,000 gallons per year.

The combined average savings for these companies in Tennessee and Alabama were over $94,000 per year.

True Cost of Waste - Other studies show that most companies are unaware of the true total costs of their wastes. Orr & Boss, industrial consultants, reported in 1994 that for many manufacturing operations the total cost of wastes exceeds the cost of labor. Sometimes the total costs of waste is 2-5 times the cost of labor. Most of this cost is overlooked and undocumented by most companies. The primary cost tracked by most companies is waste disposal cost. Yet according to Orr & Boss this normally represents only 5-10 percent of the true total costs for waste materials.

The major cost which is undefined is the value of the raw materials, labor and other process costs which are contained in every waste material. For example, a company making pressed plastic parts found that its true total cost of waste was $4.30 million per year while labor was only $2.75 million per year. Of this total disposal costs only accounted for 3.5 percent. Lost raw materials was over 93 percent. Another company assisted by Orr & Boss had waste cost over three times their labor cost. Over 96 percent was lost raw materials while only 2.2 percent was disposal cost.

The primary cost of waste is wasted materials. This can be found or concealed in: loss allowances, production variances, scrap and obsolescence, and inventory shrinkage. Another cost which may be overlooked is the cost of cleanup of spills. This should include: cleanup materials, labor, and cost of disposal. The fees for disposal of waste are usually tracked, however, the personnel time to comply with regulations and complete all necessary reports usually disappears into plant or corporate overhead.

According to Green Ledgers: Case Studies in Corporate Environmental Accounting , edited by Ditz, Ranganathan, and Banks, and published by the World Resources Institute in 1995; traditional cost accounting often “hides”

environmental costs in two ways: by burying them in non-environmental accounts and by failing to link costs to the activities which create them.

A classic example would be a company which was a large quantity generator because of paint waste generated once per year during the cleaning out of a large dip tank. Because this occurred during their annual maintenance outage, the disposal of this waste was charged to maintenance not to the production process utilizing the paint tank. Another example are companies which charge all disposal fees and other environmental costs to plant overhead and thus mask the fact that one product line is responsible for 70 percent of the facilities waste costs.

Even during a waste reduction assessment some waste types are often overlooked. These include:

- damaged raw materials
- unused raw materials
- low power factor
- inefficient lighting
- wasted labor
- spills & leaks
- equipment cleaning wastes
- excess heat

Measurements - Even in highly competitive industries process efficiencies and wastes can vary widely. Measurements are essential if a company wants to stay competitive. A truism from the total quality movement is that you can't control what you can't measure. What should you measure? I suggest the following:

- quantity of waste(s) generated per production unit or activity
- material toxicity, both in raw material components and in waste(s)
- raw material consumption or use per production unit
- costs

Measurements must be normalized to avoid being skewed by production levels or other factors. Some possible factors include:

- units produced
- area, weight or volume of product
- hours of labor
- hours of production

To make meaningful measurements you should:

- establish a baseline
- quantify each process and its wastes
- select indicators for your high priority items
- track progress of indicators

There are many existing sources of information about process wastes. These include:

- Permit Applications (Air, NPDES, etc..)
- Permit Reports
- TRI Reports
- Utility Bills
- Landfill tickets for solid wastes
- Hazardous Wastes Shipping Manifests
- Purchasing Records
- Material Safety Data Sheets

One benefit of the geometric increase in the power of microchips and their decrease in price is that we can measure, cost-effectively, processes that we could not a decade past. There are instruments, bar codes, and computer tracking systems that enable us to measure and analyze data that was simply unobtainable. However, measurements alone are worthless. Data must be analyzed or evaluated to serve any useful purpose. Just as we must continually ask why each waste is being generated, we must continually ask why measurements are being taken.

Data must also be accurate and representative to be meaningful. Good design and quality control are essential. Bad measurements will lead to bad decisions. It is better to use your resources to gather a few good data points than for a lot of poor data. If you can't gather real physical data in a cost-effective manner, begin with the best assumptions you have and refine them as necessary. Continuous improvement principles must also be applied to measurement systems.